CLAIMS

1. A neurostimulating lead comprising:

(a) an elongated, flexible polymeric body member of a predetermined length having a proximal end and a distal end;

(b) a plurality of conductors embedded within said body member and extending the predetermined length of the body member;

(c) a plurality of tunnels, each extending radially inwardly from an outer surface of the body member to at least one of said plurality of conductors;

(d) a plurality of multi-layer, thin film electrodes deposited on said outer surface at discrete, longitudinally-spaced locations proximate the distal end of said body member;

(e) electroplated conductive links extending through said tunnels from at least one of said plurality of conductors to at least one of said plurality of thin film electrodes; and

(f) at least one connector having contacts electrically joined to the conductors at the proximal end of the body member and adapted to connect the lead to a neurostimulator.

2. The neurostimulating lead as in Claim 1 wherein the polymeric body member is tubular, having an annular wall defining an internal lumen extending between the proximal end and the distal end with said plurality of conductors being spiral wound and embedded in the annular wall.

3. The neurostimulating lead of Claim 2 wherein the tubular member is polyurethane and has an outer diameter of about 2 Fr. and an internal diameter of about 0.012 inch.

4. The neurostimulating lead as in Claim 3 wherein said plurality of conductors have a substantially rectangular cross-section, 0.004 inches wide by 0.002 inches high.

5. The neurostimulating lead as in Claim 4 wherein said plurality of conductors are of a metal selected from a group consisting of stainless steel, and MP35.

6. The neurostimulating lead of Claim 2 wherein turns of said plurality of spiral wound conductors are longitudinally spaced from each other, each turn being at an angle of about 45° to a longitudinal axis of the tubular member.

7. The neurostimulating lead of Claim 6 wherein each of said thin film electrodes spans and is electrically connected by said links to at least one turn of a given one of the plurality of conductors.

8. The neurostimulating lead of Claim 6 wherein each of said thin film electrodes spans and is electrically connected by said links to more than one turn of a given one of said plurality of conductors.

9. The neurostimulating lead of Claim 1 wherein the electroplated conductive links are ~~comprises~~ of a metal selected from a group consisting of Au, Ag, Pt, Pt-Ir and Ti.

10. The neurostimulating lead of Claim 1 wherein each of said plurality of electrodes is a ring electrode.

11. The neurostimulating lead of Claim 1 wherein said plurality of electrodes includes first and second electrode segments disposed ~~in~~ along a longitudinal dimension of the body member in overlapped relation, said electrode segments adapted to be electrically connected to one of a voltage of positive polarity, a voltage of negative polarity or zero voltage.

12. The neurostimulating lead of Claim 10 wherein each of said ring electrodes comprises multiple superposed nanocrystaline metal layers with an innermost layer of a metal selected from a group consisting of Ti, Cr, Ni and Al ~~Au~~ and having a thickness less than about 5 microns, a layer adjacent the innermost layer of a metal selected from a group consisting of Pd and Pt and having a thickness between 500 angstroms and 50 microns, an ~~the~~ outermost layer

of a metal selected from a group consisting of Au, Pt and Pt-Ir and having a thickness between 500 angstroms and 50 microns, and a layer adjacent the outermost layer of a metal selected from a group consisting of Ag, Pt, PtIr, Au and Cu and having a thickness between 2 microns and 250 microns.

13. A method for fabricating a peripheral nerve stimulating lead comprising the steps of:

(a) extruding an elongated plastic tubular member having a proximal end, a distal end and a wall defining a lumen extending between the proximal end and the distal end;

(b) wrapping a plurality of conductors about the tubular member in spaced spiral relation, the plurality of conductors extending from the proximal end to a zone proximate said distal end;

(c) embedding the plurality of electrodes in the wall of the tubular member to electrically insulate the plurality of conductors from one another;

(d) forming a plurality of radially extending tunnels into the wall in said zone leading to each of said plurality of conductors;

(e) electroplating a metal through said plurality of tunnels to provide conductive paths from said plurality of conductors to an outer surface of the wall;

(f) depositing a plurality of multi-layer thin film electrodes onto said outer surface in longitudinally-spaced relation and contacting said conductive paths; and

(g) attaching an electrical connector to the plurality of conductors at the proximal end of the tubular member.

14. The method as in Claim 13 and further comprising the step of providing a guide wire for insertion through said lumen.

15. The method of Claim 13 wherein the plastic is polyurethane.

16. The method of Claim 13 wherein the extruding step yields a tubular member having an outer diameter in a range of from 0.020 inch to 0.030 inch and an inner diameter in a range of from 0.010 to 0.013 inches.

17. The method of Claim 13 wherein the wrapping step includes wrapping at least four conductors about the tubular member.

18. The method of Claim 17 wherein the conductors have a rectangular cross-section about 0.004 inches wide and 0.002 inches thick.

19. The method of Claim 18 wherein the conductors are formed of a metal selected from a group consisting of stainless steel and MP35 alloy.

20. The method of Claim 13 wherein the wrapping step includes wrapping the plurality of conductors about the tubular member at an angle to a longitudinal axis of the tubular member that varies directly with the number of conductors employed.

21. The method of Claim 13 wherein the depositing step includes vacuum depositing of a plurality of superimposed layers of differing metals over an area of said outer surface spanning at least one turn of a given one of said spiral wrapped conductor.

22. The method of Claim 13 wherein the electroplating step includes the steps of connecting said conductors at a proximal end thereof to a DC voltage source and submerging the zone in a plating bath containing ions of a selected metal.

23. The method of Claim 10 wherein the step of forming a plurality of tunnels includes focusing a laser beam on the surface of the wall at selected locations overlaying portions of the plurality of conductors and vaporizing the plastic tubular member with laser energy at the selected locations to form said tunnels.

24. In a neurostimulating lead of the type comprising an elongated, plastic tubular member having a proximal end, a distal end and an annular wall defining a lumen, at least

one electrode affixed proximate the distal end of the tubular member and an elongated conductor embedded in the wall of the tubular body and extending from the proximal end to the distal end of the tubular body, a method of connecting the conductor to the electrode comprising the steps of:

(a) before forming the electrode on the distal end of the tubular body, creating a plurality of openings through the wall leading to the embedded conductor;

(b) electroplating a conductive metal through the plurality of openings, and thereafter;

(c) depositing said electrode on an outer surface of said wall so as to establish electrical contact with the electroplated conductive metal in the openings.

25. The method as in Claim 24 wherein the plurality of openings are created by focusing a laser beam on said exterior surface of the wall and burning through the wall to the embedded conductor.

26. The method as in Claim 24 wherein electroplating of a conductive metal involves electroplating a metal selected from a group consisting of Au, Ag, Pt, Pt-Ir and Ti.

27. The method of Claim 24 wherein depositing said electrodes includes vapor depositing selected metals as multiple superposed nanocrystaline layers with the composite thickness of the resulting electrode being less than about 350 microns.